

## PATENT SPECIFICATION



Application Date : June 7, 1927. No. 15,007 / 27.

296,742

Complete Left : Jan. 12, 1928.

Complete Accepted : Sept. 7, 1928.

## PROVISIONAL SPECIFICATION

**Improved Electromagnetic Means for Vibrating or Reciprocating  
the Spring Balanced or Supported Tables, Screens, Trays or  
the like of Concentrating, Sifting, Conveying, Moulding and  
similar Apparatus.**

I, JOSEPH WILLIAM SHEEWEN, of Dean Street House, Hexham-on-Tyne, in the County of Northumberland, a British subject, do hereby declare the nature of this invention to be as follows :—

This invention relates to electromagnetic means for vibrating or reciprocating the spring balanced or supported tables, screens, trays or the like of concentrating, sifting, conveying, moulding and similar apparatus, and has for its object to provide improved means for this purpose.

According to this invention, I employ electromagnetic mechanism adapted to impart a rapid series of pulls or pushes to the spring balanced or supported table, screen, tray or the like of a concentrating, sifting, conveying, moulding or similar apparatus, said mechanism being actuated and adjusted so that the frequency of its pulls or pushes automatically synchronizes with the natural frequency of the balancing or supporting springs of the table or the like, whereby an accumulative effect is obtained, the pulling or pushing mechanism co-acting with the balancing or supporting springs to give an increasing vibration or reciprocation to the table or the like until the maximum effect is attained.

The pulling or pushing mechanism conveniently comprises a solenoid or magnetic coil, the core of which is suitably connected to the table or the like of the concentrating or similar apparatus, the current energizing said solenoid passing through a make-and-break device operated in unison with the table, a suitable condenser being provided across the solenoid terminals to prevent or minimise sparking at the make-and-break contacts. A resistance may also be inserted in the circuit, if desired. The solenoid may be designed for either alternating or direct current, the core being laminated in the case of alternating current. If desired, the solenoid may be water-jacketed to prevent over-heating.

In one arrangement, the table or the

like of the concentrating or similar apparatus is connected, through a universal coupling if desired, to a crosshead mounted at one end of a pair of parallel rods which have a crosshead at their other end to which the core of the solenoid is attached. The rods pass freely through holes or bearings in a pair of upstanding brackets, which may be of angle iron, forming fixed abutments for a pair of springs which bear on the opposite faces of a central abutment mounted on the parallel rods. The ends of the springs are received in short tubes or sockets secured to the stationary brackets and to the central abutment, and nuts are inserted in the inner ends of the tubes on the stationary brackets, said nuts being free to slide but prevented from rotating. The nuts engage right- and left-hand threaded portions of a central spindle which passes through bearings in the fixed brackets, and freely through the springs and central abutment. This spindle is provided at one end with a wormwheel adapted to be rotated by a worm on a short spindle mounted in suitable bearings and provided with a handwheel. The tension of the springs can be adjusted by rotating the threaded spindle by means of the handwheel and worm gear, the tightening or slackening of the springs giving a shorter or longer stroke and also increasing or decreasing the frequency of the stroke. The springs may be of equal power, or one spring may be stronger than the other. Usually the springs are chosen and arranged so as to give the table a quick return stroke, the spring further from the solenoid being the stronger of the two.

Carried by one of the parallel rods or one of the crossheads is an insulated contact finger adapted to co-act with a finger on the base of the apparatus, one or both of said fingers being adjustable. The fingers are connected in series with the solenoid and form a make-and-break device operating in unison with the table. The make-and-break device is arranged so

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that the solenoid is energized during one stroke only (usually the return stroke) of the table so that the pull of the solenoid on its core is applied through the cross-heads and rods to the table and synchronizes with the push of the stronger spring. The pull of the solenoid is thus added to the push of the spring and is timed to synchronize with the natural frequency of the spring thus making full use of the energy stored in the reciprocating parts of the apparatus. Ball bearings are or may be fitted where desirable to reduce friction. The material on the table thus receives an intensified throw in one direction.

Where one spring is stronger than the other and the stronger spring is that further from the solenoid, when the springs are tightened up and more power is required to vibrate them, increased power is automatically provided by the solenoid owing to the core being advanced into the solenoid by the movement of the central abutment towards the solenoid due to the stronger spring partially overcoming the resistance of the weaker spring nearer the solenoid.

In another arrangement, the table, screen, tray or the like is mounted on laminated springs fixed at their other

ends, and the pull or push of the solenoid is applied through a universal joint to one or other of the springs, the moving contact of the make-and-break device being mounted on an extension of the solenoid core. The connection between the solenoid and the spring is adjustable to vary its point of application to the spring, i.e. to move it nearer or further away from the fixed anchorage of the spring and so adjust the stroke and frequency of the vibrations.

In the above arrangements, the springs alone provide the power for one stroke, but in some cases it may be desirable to provide a pair of solenoids, one solenoid being arranged to pull or push in one direction and the other solenoid in the opposite direction, said solenoids being energized alternately so that the power of a solenoid is added to that of a spring during both the forward and the return strokes. If desired, a solenoid may be associated with each spring.

Dated this 3rd day of June, 1927.  
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#### COMPLETE SPECIFICATION.

### Improved Electromagnetic Means for Vibrating or Reciprocating the Spring Balanced or Supported Tables, Screens, Trays or the like of Concentrating, Sifting, Conveying, Moulding and similar Apparatus.

I, JOSEPH WILLIAM SHERWIN, of Dean Street House, Hexham-on-Tyne, in the County of Northumberland, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to electromagnetic means for reciprocating the tables, screens, trays or the like of concentrating, sifting, conveying, moulding and similar apparatus, and refers to means of the kind wherein the electromagnetic means operate in opposition to adjustable springs and are controlled by make-and-break devices actuated in unison with the movements of the table. The present invention has for its object to provide improved means, very simple in construction and operation for this purpose.

Mechanism according to this invention is of the kind above referred to and is

characterised in that the movements of the core or armature of the electromagnetic device are transmitted to the table or the like through a frame carrying an abutment interposed between a pair of oppositely-acting springs. The springs are adjustable to vary the stroke and frequency of the reciprocations of said frame and hence of the table, screen, tray or the like connected thereto. Preferably, where the table is spring supported, the electromagnetic mechanism is adjusted so that the frequency of its pulls or pushes automatically synchronises with the natural frequency of the supporting springs of the table whereby an accumulative effect is obtained, the electromagnetic pulling or pushing mechanism coacting with the supporting springs to give an increasing amplitude of reciprocation to the table until the maximum effect is attained.

The electromagnetic mechanism con-

veniently comprises one or more solenoids or magnetic coils or poles, the core or cores or armature or armatures of which is or are suitably connected to the table or the like of the concentrating or similar apparatus, the current energising said solenoid or solenoids, coils or poles being controlled by a make-and-break device or devices operated in unison with the table.

A suitable condenser is provided across the solenoid terminals in light machines, or across the make-and-break contacts in the case of heavy machines, to prevent or minimise sparking at the make-and-break contacts. A discharge resistance may also be inserted in the circuit, if desired. The solenoid, coils or poles may be designed for either alternating or direct current, though a direct current is preferable.

I will more fully describe my invention with reference to the accompanying drawings wherein Figure 1 is a side elevation of one construction of vibrating mechanism in accordance therewith applied to a concentrating table of known type; Figure 2 is a part similar view to a larger scale; Figure 3 is a sectional plan on the line X—Y in Fig. 2; Figure 4 is a plan of the make-and-break mechanism, the cover of the box wherein it is housed being removed; and Figure 5 is a diagram of the electrical connections. Figures 6 and 7 are similar views to Figs. 2 and 3 respectively illustrating a modified construction.

Referring to the said drawings, in the example illustrated in Figs. 1 to 5, the table or the like 10 (Fig. 1) of the concentrating or similar apparatus is mounted on spring legs 9 and is connected, through a universal coupling 11 if desired, to a crosshead 12 mounted at one end of a pair of parallel rods 13 which have a crosshead 14 at their other end to which the core 15 of a solenoid 16 is attached at 17. The rods pass freely through bearings 18 in a fixed upstanding bracket 19 at one end of a base 20 and through bearings 21 in lugs 22 on the casing 23 of the solenoid.

Adjustable nuts 24, 24<sup>a</sup> forming abutments for a pair of springs 25, 26 are provided on a stationary threaded rod 27 mounted between the bracket 19 and the end cover 28 of the solenoid casing. The springs 25, 26 bear on the opposite faces of a central abutment 29 mounted between the rods 13 and having an aperture 30 through which the threaded rod 27 passes freely. The tension of the springs 25, 26 can be adjusted by rotating the nuts 24, 24<sup>a</sup>. In the example illustrated, the spring 26 is stronger than the spring 25 so as to give the table 10 a quick rebound at the end of its forward stroke, the stronger spring acting against the pull of the solenoid 16. If desired, the springs may be of equal strength. Tightening or slackening of the nut 24<sup>a</sup> gives a shorter or longer stroke and hence increases or decreases the frequency of the stroke. A rubber buffer 31 is attached to the crosshead 12 and coacts with a fixed abutment 32 on the base 20. If desired a spring may be substituted for the buffer 31.

It will be seen that, if the nut 24<sup>a</sup> is rotated to travel it towards the left, the stroke of the table is lengthened and the frequency of its reciprocations decreased by reason of the permitted expansion of the springs 25, 26 and the increase of the normal space between the buffer 31 and the abutment 32 due to the movement of the central abutment 29 under the co-action of the springs in the same direction as the nut 24<sup>a</sup> but to a less extent. The nut 24 is not moved after initial adjustment. Rotation of the nut 24<sup>a</sup> to travel it to the right compresses the springs, the weaker spring 25 being more compressed than the spring 26 (the strength of the spring 25 can be increased by compression until it equals that of the spring 26), and the stroke of the table is shortened and its frequency increased by reason of the compression of the springs and the decrease of the space between the buffer 31 and abutment 32 due to the consequent movement of the central abutment 29.

Carried by the crosshead 14 is a finger 33 carrying an adjustable stud 34 adapted to coact with the outer end of a pin 35 projecting from a bridge piece 36 mounted on rods 37 in a box 38, springs 39 on the rods 37 behind the bridge pressing it and the pin 35 towards the stud 34. The springs 39 bear against a partition 40 across the box 38 which supports the inner ends of the rods 37, the outer ends of which are supported by the end of the box in which is an aperture for the pin 35. The bridge 36 carries a pair of insulated contacts 41 which coact with insulated contacts 42 on the adjacent end of the box 38, said contacts being connected in series with the solenoid 16 as shown in Fig. 5. A condenser 43 is connected across the contacts 41, 42, and a tapped discharge resistance 44 is connected across the contacts and solenoid 16 as shown in Fig. 5, the condenser and resistance being of any suitable type and being conveniently disposed in the compartments 46, 47 in the box 38. In a light machine the resistance 44, may be dispensed with and the condenser connected in parallel with the contacts and the solenoid. The contacts 41, 42, being actuated by the finger 33 on the crosshead 14, form a make-and-break device operat-

ing in unison with the table 10. The solenoid is energised when the table 10 is in mid-position, and during a portion of the forward stroke (to the right) of the 5 table, the pull of the solenoid on its core 15 being applied through the crossheads 12 and 14, the rods 13 and the coupling 11 to the table, the stronger spring 26 being compressed during this stroke. The 10 forward stroke is completed when the buffer 31 strikes the abutment 32. Before the completion of the forward stroke, the stud 34 on the finger 33 strikes the pin 35 of the bridge 36 and disengages the 15 contacts 41, 42 thus breaking the circuit and de-energising the solenoid. The stronger spring 26 returns the table against the cushioning action of the weaker spring 25, and, soon after the commencement of the return stroke (to the left), the stud 34 disengages the pin 35 20 and allows the contacts 41, 42 to re-engage and make the circuit again so that the solenoid is re-energised and assists the spring 25 to retard the table 10 during its return stroke until the pull of the solenoid and the resistance of the spring 25 overcome the return movement of the table and the table again moves to the right 25 when the cycle of operations is repeated. The solenoid is thus energised except for a short portion of the travel of the table before and after the buffer 31 strikes the abutment 32. The pull of the solenoid is 30 added to the push of the weaker spring 25 during the forward stroke of the table, and the reciprocations of the table synchronise with the operation of the make-and-break device. The springs 25, 26 are 35 initially adjusted by means of the nuts 24, 24<sup>a</sup> to balance the table in mid-position on its spring legs 9, and, on current being supplied to the solenoid 16, the table commences to reciprocate, the reciprocations 40 of the table rapidly increasing in amplitude until the maximum efficiency of the mechanism is attained, the frequency of the reciprocations synchronising with the natural frequency of the spring-balanced 45 table, full advantage being taken of the energy stored in the reciprocating parts of the apparatus. The material on the table receives an intensified throw at the end of the forward stroke due to the quick arrest 50 of the table when the buffer 31 strikes the abutment 32. Ball or roller bearings are or may be fitted where desirable to reduce friction.

When the springs 25, 26 are tightened 55 up by adjusting the nut 24<sup>a</sup> on the threaded rod 27 and more power is required to reciprocate the table, increased power is automatically provided by the solenoid owing to its core being advanced 60 into the solenoid by the movement of the

central abutment 29 to the right due to the compressed spring 25 partially overcoming the resistance of the spring 26.

As will be readily understood, the finger 70 33 carrying the stud 34, instead of being mounted on the crosshead 14, may be mounted on one of the parallel rods 13 (as shown in Fig. 7) on the crosshead 12, or on the table 10, the make-and-break device being disposed to suit.

In the example above described and illustrated in Figs. 1 to 5 of the drawings, the spring 26, spring legs 9 and buffer 31 alone provide the power for the return stroke, but in some cases it may be desirable to provide a pair of solenoids such as 80 16, one solenoid being stronger than the other and arranged to pull or push in one direction while the other solenoid pushes or pulls in the opposite direction, said solenoids being energised alternately so that the power of a solenoid is added to that of a spring 25 or 26 during both the forward and the return stroke. Where very heavy apparatus is to be reciprocated, two or more solenoids or pairs of solenoids 85 may be provided arranged in tandem and connected so as to operate in unison.

If desired, the solenoid may be water-jacketed to prevent over heating.

As illustrated in Figs. 6 and 7, where alternating current is to be employed, an oscillating motor 16<sup>a</sup> may be substituted 100 for the solenoid 16, said motor comprising a pair of oppositely disposed suitably wound stationary poles between which is mounted an armature adapted to oscillate between said poles through an angle of less than 90°, the coils of said poles and 105 of the armature being connected in series or parallel and the current thereto being controlled by a make-and-break device operated as above described, the attraction of the poles swinging the armature 110 into alignment therewith. The armature is suitably connected to the reciprocating frame formed by the crosshead 12, the parallel rods 13 and the central abutment 115 29, for example through arms 48 fixed on a central spindle 49 on which the armature is fixedly mounted, said arms being slotted as shown to engage pins 50 in the forked ends of the rods 13, the crosshead 14 being dispensed with, and the bearings 120 21 of the rods 13 being supported by lugs 22 on the casing of the oscillating motor 16<sup>a</sup>. The operation of this modified construction is the same as that of Figs. 1 to 125 5, and, while it is particularly applicable where alternating current is employed, it may be adopted where direct current is used.

The table 10 or other apparatus to be reciprocated may be attached to either 130

end of the device, the springs 25, 26 being arranged to suit.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :—

1. Electromagnetic means of the kind herein referred to for reciprocating the tables, screens, trays or the like of concentrating, sifting, conveying, moulding and similar apparatus characterised in that the movements of the core or armature of the electromagnetic device are transmitted to the table or the like through a frame carrying an abutment interposed between a pair of oppositely-acting springs, substantially as and for the purposes herein described.
2. Electromagnetic means as claimed in Claim 1 wherein the oppositely-acting springs are adjustable to vary the stroke and frequency of the reciprocations of the frame and hence of the table or the like connected thereto, substantially as herein described.

3. Electromagnetic means as claimed in Claim 1 wherein the frame comprises a pair of crossheads rigidly connected by parallel rods between which is fixed the abutment with which the oppositely-acting springs coact, substantially as herein described. 30

4. Electromagnetic means as claimed in Claim 1 provided with a make-and-break device constructed, arranged and adapted to operate substantially as and for the purposes herein described. 35

5. The improved reciprocating mechanism constructed, arranged and adapted to operate substantially as and for the purposes herein described with reference to the accompanying drawings, and subject to the modifications herein referred to. 40

Dated this 12th day of January, 1928.

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Abingdon: Printed for His Majesty's Stationery Office, by Burgess & Son.  
[Wt. 95*1*.—50/1/1933.]

296,742. COMPLETE SPECIFICATION

2nd Edition

SHEET 1

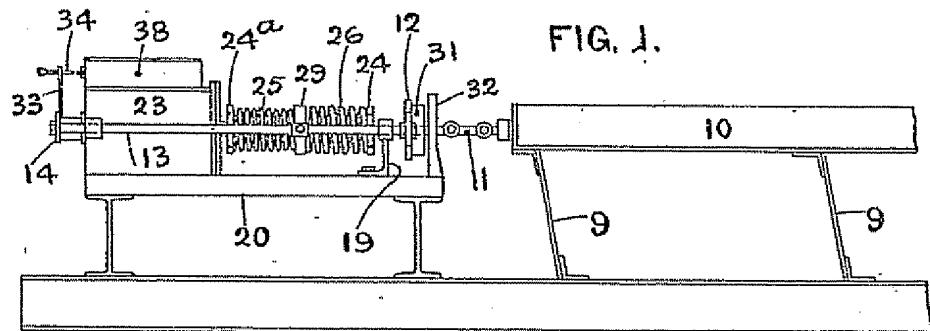


FIG. 1.

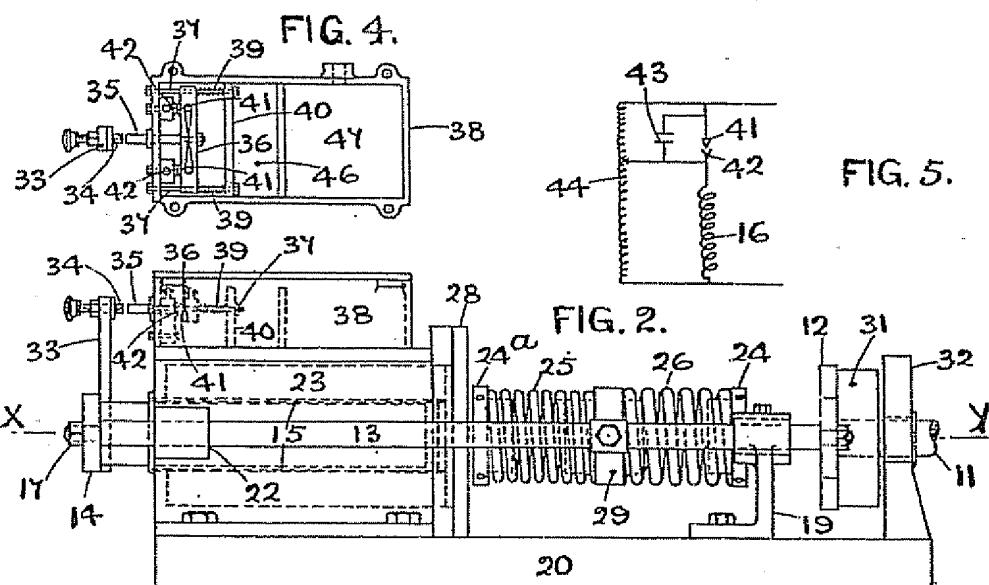


FIG. 2.

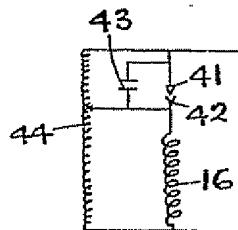
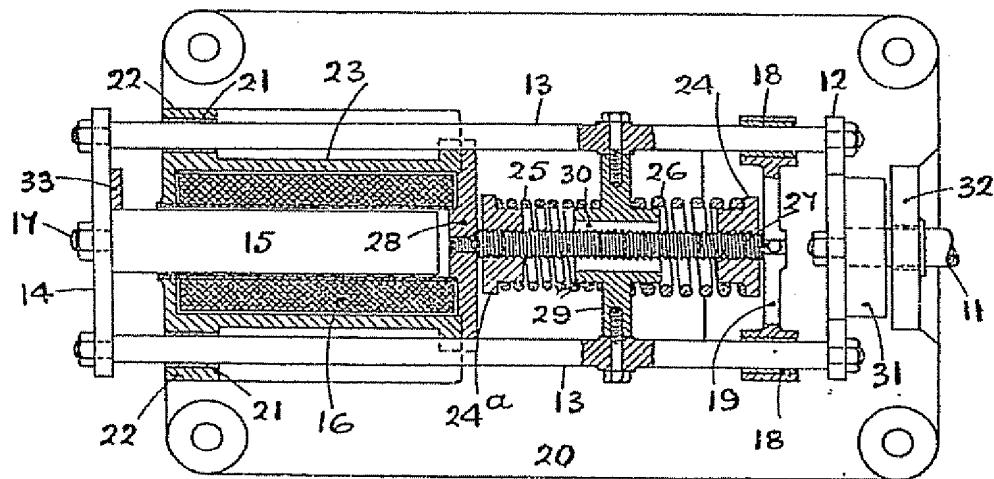


FIG. 5.

FIG. 3.



*[This Drawing is a reproduction of the Original on a reduced scale.]*

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FIG. 5.

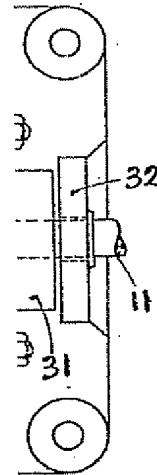
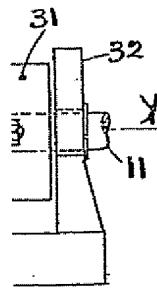


FIG. 6.

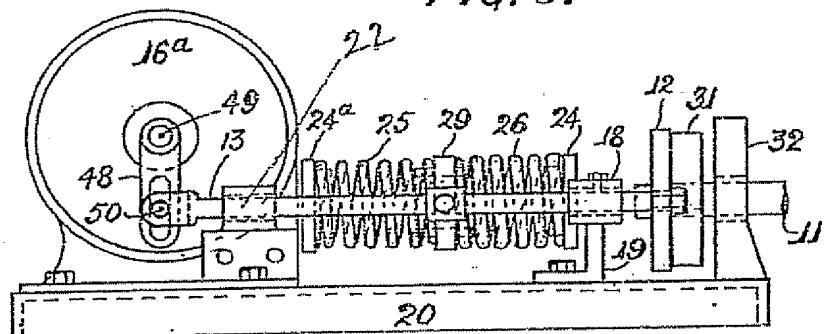
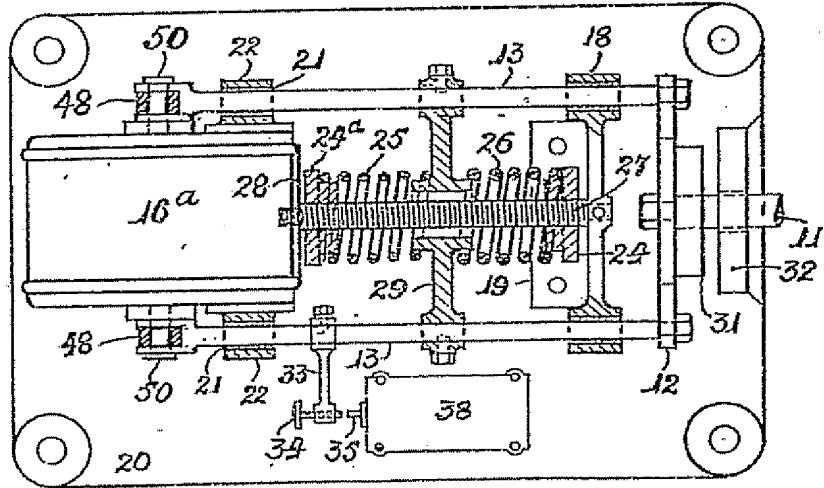
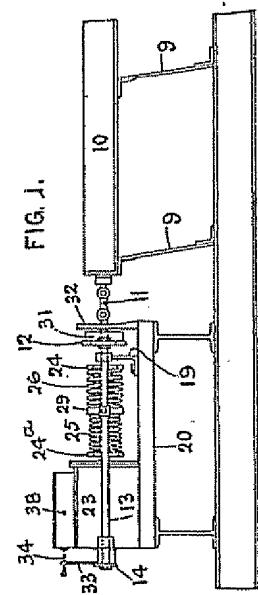


FIG. 7.

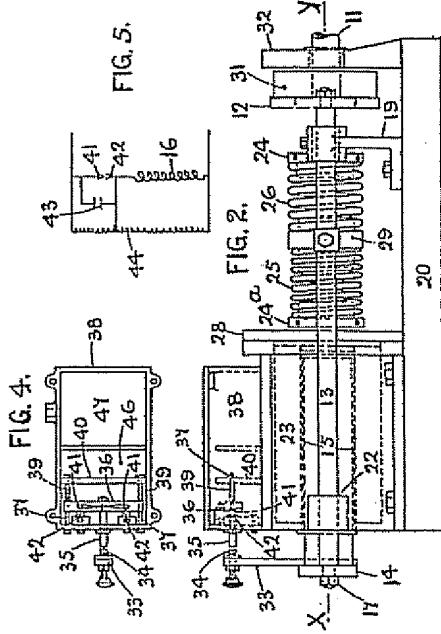


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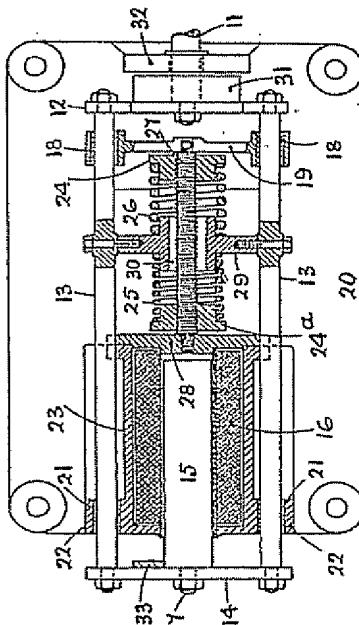
2nd Edition



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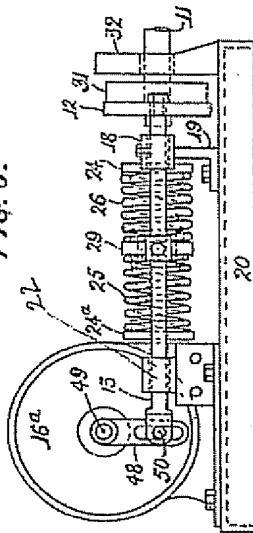
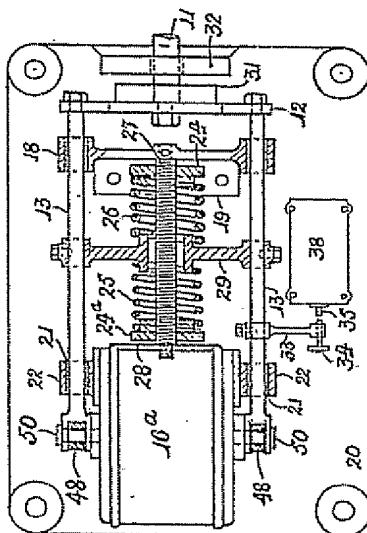


FIG. 6.



E/G. 7.